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(*J. T. S.* ix pp. 321 ff); firstly that 'the Yahwe of Abraham was originally connected with the deity Sin', and secondly (as witnessed by the antiquity of the names Kiriath 'Arba, Beer Sheba', and their association with the Patriarchs), that this Deity was known and worshipped in Canaan prior to the settlement there of the tribes of Israel.

C. F. BURNEY.

ASTRONOMICAL EVIDENCE FOR THE DATE OF THE CRUCIFIXION.

In the *Journal of Philology* xxix (1903) pp. 100-118, I discussed the date of the crucifixion from the point of view of technical and astronomical chronology. A discussion of the same question, partly based on my article, was contributed by Dr Bacon under the title of *Lucan versus Johannine Chronology* to the *Expositor*, Seventh Series iii (1907) pp. 206-220. In both articles it is maintained that the beginning of each Jewish month was determined empirically, and both articles depend on calculations, made by me, of the first appearance of the moon in every month which can possibly be regarded as the month of the crucifixion. In my article I expressed regret that there was no table in existence, shewing the depression of the sun below the horizon at moonset, or the altitude of the moon above the horizon at sunset, necessary to render the moon visible to the naked eye, and, in the absence of exact data, I fell back upon a vague rule given by Hevelius. Since then I have made an investigation of seventy observations of the visibility or invisibility of the young moon, made for the most part by Julius Schmidt at Athens and published in August Mommsen's *Chronologie* (1883) pp. 69-80. My discussion of these observations will be found in *Monthly Notices of the Royal Astronomical Society* lxx (1910) pp. 527-531. In this paper I found that the conditions of visibility may be expressed in terms of the difference in true azimuth and true altitude of the sun and moon at sunset, and I tabulated my conclusion as follows:—

True Difference in Azimuth at Sunset.	Minimum True Altitude of Moon at Sunset to be visible same evening.
0	0
5	12.0
10	11.9
15	11.4
20	11.0
23	10.0
	7.7

This solution is independent of differences in latitude, but not necessarily of differences in the clearness of the air between one place and another. The striking uniformity of the Athenian observations suggested, however, that the problem is almost purely astronomical, and not atmospheric. Happily, the same problem engaged the attention of Maimonides,¹ who, though silent as to the observations on which his conclusions rest, gives a detailed rule for determining the date of the first visibility of the moon in Palestine. The result, according to his theory, depends partly on the true elongation or difference in true longitude between sun and moon, and partly on the apparent angle of vision at the moment when the moon might be expected to appear. This moment is, according to him, on an average twenty minutes after sunset. By the angle of vision he appears to mean the apparent difference in zenith distance between sun and moon.

Maimonides's conclusion may be summarized as follows:—If the angle of vision exceeds 11° , the moon is visible; if the angle of vision is between 10° and 11° , the moon is only visible if the elongation exceeds 12° ; if the angle of vision is between 9° and 10° , the moon is only visible if the elongation exceeds 13° ; if the angle of vision is less than 9° , the moon is only visible if the elongation exceeds 24° .

Converting this rule to the form in which I have expressed mine, I get:—

True Difference in Azimuth at Sunset.	Minimum True Altitude of Moon at Sunset to be visible same evening.
0	0
5	11.8
10	11.3
15	9.7
20	9.7
23	7.3

There is no reason for doubting that the rule given by Maimonides is the result of trustworthy observations. By making a leap of a degree at a time, it gives a somewhat discontinuous result, and therefore cannot be pressed in detail, but it appears to shew that the conditions of observation are slightly more favourable at Jerusalem than at Athens. Maimonides also gives rules for computing the moon's elongation and angle of vision, but they are very inaccurate compared with the methods of modern astronomy.

¹ In his treatise on the Sanctification of the New Moon, translated into German, with astronomical comments, by von Littrow in *Sitzungsberichte der Wiener Akademie*, Math.-Naturw. Classe, lxvi (1872) Abth. ii pp. 459-480.

The following table shews the true altitude of the moon at sunset and the true difference in azimuth of sun and moon at sunset at Jerusalem for the first two sunsets after the new moon of Nisan in each of the years, 26-35 A.D. In the case of 26 and 29 I have computed for two different new moons, as there may be some doubt as to the identity of the new moon of Nisan in those years. The table also shews on which evenings the moon ought to be visible according to my formula, and on which days of the year and week Nisan 14 ought to fall.

A. D.	Day.	Moon's Altitude at Sun-set.	Difference of Azimuth at Sun-set.	Result.	Day.	Moon's Altitude at Sun-set.	Difference of Azimuth at Sun-set.	Result.	Date of Nisan 14.
26	Mar. 8	10.7	4.8	Invisible;	Mar. 9	23.9	8.0	Visible	Sa., Mar. 23
26	Apr. 6	5.9	5.4	Invisible;	Apr. 7	18.6	8.3	Visible	Su., Apr. 21
27	Mar. 27	10.7	6.6	Invisible;	Mar. 28	23.6	9.1	Visible	F., Apr. 11
28	Mar. 15	6.3	5.9	Invisible;	Mar. 16	17.6	8.0	Visible	Tu., Mar. 30
29	Mar. 4	5.6	6.0	Invisible;	Mar. 5	15.9	8.4	Visible	Sa., Mar. 19
29	Apr. 3	9.4	5.9	Invisible;	Apr. 4	20.4	7.3	Visible	M., Apr. 18
30	Mar. 23	9.3	5.4	Invisible;	Mar. 24	20.3	6.5	Visible	F., Apr. 7
31	Mar. 12	8.0	4.9	Invisible;	Mar. 13	19.9	6.0	Visible	Tu., Mar. 27
32	Mar. 30	10.2	3.0	Invisible;	Mar. 31	25.6	3.1	Visible	M., Apr. 14
33	Mar. 19	2.8	0.9	Invisible;	Mar. 20	16.8	1.5	Visible	F., Apr. 3
34	Mar. 9	10.1	4.5	Invisible;	Mar. 10	21.3	1.2	Visible	W., Mar. 24
35	Mar. 28	7.1	2.6	Invisible;	Mar. 29	20.9	1.6	Visible	Tu., Apr. 12

There is a certain amount of dispute among astronomers about the correct values for some of the constants used in the above computation. I have endeavoured to select the best constants in each case, but no set of constants would give altitudes differing by so much as $0^{\circ}.2$ from mine, and the correction to the difference of azimuth would be much more minute.

It will be observed that in each instance the moon lies well on one side or other of the dividing line between 'Visible' and 'Invisible', as given in my summary table; there can, therefore, be little doubt that, except where the first appearance was delayed by clouds, it took place on the day specified above. On 27 March 27 the moon would, it is true, lie just on the dividing line which I have deduced from Maimonides's rule, although she stands one degree below the line as resulting from the Athenian observations. But, as suggested above, the line deduced from Maimonides appears to require smoothing, in which case the moon would be invisible on that date according to his rule as well as according to that deduced from the Athenian observations.

A comparison of the above table with the figures that I published tentatively in the *Journal of Philology* will shew that in six instances, viz. 28, 29 twice, 30, 31, and 33, I formerly placed the first appearance of the moon one day too late. On the other hand, Wurm, who was content to allow a minimum interval of thirty-six hours between new moon and first appearance, was in error in six instances only.¹ Salmon,² who is followed by Mr Turner,³ allowed a minimum interval of thirty hours, which should have given him an erroneous date in the year 33 only. But he saves this error by quoting two alternative dates for that year. While it is clear that in my former paper I attached too much weight to causes other than the age of the moon, it is also clear that Salmon's success with a calculation based on age alone was largely a matter of luck. Thus the moon of 34 March 9 was new three hours later in the day than the moon of 29 March 4, yet it had an altitude of $10^{\circ}.1$ as against $5^{\circ}.6$ at the following sunset, and of $21^{\circ}.3$ as against $15^{\circ}.9$ at the sunset of the evening on which it would be visible for the first time. The moon of 34 March 9 would in fact be visible in the latitude of Jerusalem, though in another longitude, about sixteen hours after it was new, while the moon of 29 March 4 would take thirty hours to reach an equally favourable position. But as the appearance at Jerusalem could not take place till just after sunset, the moon of 34 would actually be thirty-six hours old and that of 29 thirty-nine hours old when first seen. In this way both appear to obey the rule that the moon becomes visible at the first sunset not less than thirty hours after new moon.

It will be observed that if Nisan began on the evening on which the moon ought astronomically to have become visible for the first time, there is not one of the years under discussion in which Nisan 14 would fall on a Thursday, so that it would appear impossible for the crucifixion to have taken place on Nisan 15, as the synoptic gospels seem to imply. This date can only be saved, either by placing the first appearance of the moon in 27 on March 27, a date, which, as has been seen, is on the margin of possibility according to Maimonides's rule, if pressed literally, or by assuming that the moon was obstructed by clouds on 34 March 10, and that Nisan in consequence did not begin till the following evening. In order to render this possible it would be necessary to assume that the first appearance in the previous month was on February 9, for, if it were on February 8, the thirtieth day of Adar would close on the evening of March 10, and no Jewish month was permitted to contain more than thirty days. The moon appears to have narrowly failed to be visible

¹ See his paper in Bengel's *Archiv für die Theologie* ii (1817) p. 293.

² *Introduction to the New Testament* (1894) pp. 255-257.

³ *Dictionary of the Bible* (1898) p. 411.

on February 8, its altitude at sunset being $11^{\circ}0$ with a difference of azimuth of $4^{\circ}2$. It is therefore quite permissible to assume that clouds may have delayed the beginning of Nisan till the evening of March 11. If, however, 27 and 34 are both impossible on historical grounds, the synoptist date for the crucifixion will have to be abandoned.

St John's date (Nisan 14) fares much better. Here the figures give us a Friday for Nisan 14 in each of the years 27, 30, and 33. No other year can, however, be added to this list, if we maintain that the beginning of the month was determined empirically. I am pleased to find that Dr Bacon's date, 30 April 7, is now confirmed astronomically.

I should like to take this opportunity of making a few corrections and additions to my former paper. On p. 102 ll. 27, 28 of my article in the *Journal of Philology* the words 'visible' and 'invisible' should be interchanged. I should also like to abandon my reference to the Magdeburg Centuriators. The documents which they used are probably spurious, and the argument in support of which they are cited can do without their assistance.

On the general question of the empirical character of the Jewish calendar, I have met no evidence to lead me to modify the view I adopted on the authority of the Mishna, and it gains additional support from the *Κήρυγμα Πέτρον*, cited by Dr Bacon. I was at that time unaware that the Egyptian Arabs had employed a purely empirical calendar for civil life till the time of Mehemet Ali. The Elephantine papyri have brought to our knowledge a calendar used by the south-Egyptian Jews in the fifth century B.C. in which the months are made to begin, not at the first appearance of the moon, but at the sunset immediately following the mean new moon.¹ This could only be obtained by calculation, but we cannot argue from the Egyptian Jews of the fifth century B.C. to the Palestinian Jews of the first century A.D. The same papyri seem to shew an irregular intercalation, and in this respect the Jews of our Lord's time seem to have resembled their Egyptian prototypes. Sometimes the rule which I cited² from *Arachin* ii 2 is used as an argument to prove that the Jews did not entirely dispense with calendar rules, but it merely expresses the result of the two simple rules that no month was to have less than twenty-nine or more than thirty days, and that it was to be determined by observation which of these lengths a particular month should have.

Mr Turner's suggestion,³ that the calendar rule limiting Adar to twenty-nine days may go back to the time of our Lord, deserves, perhaps, a fuller treatment than I gave it in my former article.⁴ As I there

¹ See *Monthly Notices of the Royal Astronomical Society* lxix (1908) pp. 12-20.

² *Journal of Philology* xxix p. 102.

³ *Ubi supra*, p. 412.

⁴ pp. 103, 104, 115.

stated, this rule is unknown to the Mishna. I may add that it is equally unknown to the Jerusalem Talmud and the Tosefta, but the Babylonian Talmud cites it as the opinion of some rabbis as old as the third century A.D. The only reason assigned for such a rule by its advocates mentioned in the Babylonian Talmud is the same as that suggested by Mr Turner,¹ that the Jews of the dispersion might know on what day the new month was commencing in Jerusalem. This difficulty would be most seriously felt in the months of Nisan and Tishri which contained the most solemn days of the Jewish calendar, and in particular at the festival of the new year which fell on the first day of Tishri, and which might easily have to be celebrated before news could come from Jerusalem announcing the sanctification of the new moon. The Mishna is not unaware of this difficulty, and mentions some rules adopted for the benefit of the Jews of the dispersion. Beacons were lit and afterwards messengers were sent to announce the new moon. Nisan, Elul, and Tishri were all among the months when messengers were dispatched at the date of the Mishna.² The messengers in Nisan are said to have been sent for the sake of the passover, those in Elul for the sake of the new year, and those in Tishri to fix the other holy days (apparently the day of atonement and the feast of tabernacles). It will be observed that this left open a little uncertainty about the date of the new year festival, as the Jews away from Jerusalem had only the Elul and not the Tishri new moon to guide them. The messengers do not appear to have gone beyond Syria, though the beacons which were used at an earlier date carried the news as far as Babylonia. The more distant Jews might in consequence be in doubt not only of the correct date for the new year's festival, but of the dates of the feasts of passover and tabernacles as well. A simple device for remedying the difficulty is mentioned in the Mishnaic tract *Erubin*,³ where R. Judah is quoted as authorizing the doubling of the new year's festival where uncertainty exists as to the duration of Elul.

Such a rule, though devised for the convenience of the Jews of the dispersion, was capable of very inconvenient expansion. We learn from both Talmuds that some of the more zealous went the length of doubling the fast of the atonement when uncertain as to the length of Elul, and the father of Samuel b. R. Isaac is said to have died in consequence of this prolonged fast.⁴

¹ p. 411.

² *Rosh ha-Shana* i 3, 4.

³ iii 7, 8.

⁴ See the Jerusalem Talmud on *Rosh ha-Shana*, in *Talmud de Jérusalem*, &c. Schwab vi (1883) p. 68.

But the difficulty affected the Babylonian Jews more than those of Palestine, and hence it is only in the Babylonian Talmud that we read of the less laborious solution mentioned by Mr Turner. Here¹ we find it vehemently asserted by certain rabbis belonging partly to Babylonia and partly to Palestine, and denied with equal vehemence by others, that Elul could never contain more than 29 days, and that either the Adar followed by Nisan or even both Adars in an intercalary year were similarly limited, though the duration of the other months was by universal consent to be determined by observation. R. Hanina b. Kahana even asserted on the authority of Rabh that, since the time of Ezra, Elul had never had more than 29 days. In a like vein R. Simai testified in the name of Haggai, Zechariah, and Malachi that each of the Adars might be either twenty-nine or thirty days in length. Both sides declared that the custom of the diaspora supported their view of the length of Adar. Whatever the theory may have been, there are several instances quoted in the Babylonian Talmud where Elul was actually given thirty days. It is therefore not surprising that what appears to have been the older expedient should also have received an expansion. R. Zera is said to have proposed in the name of R. Nahman to double the feast of the passover, and R. Johanan finally gave orders to double the festivals both in Nisan and in Tishri. The doubling of the festivals and the limitation of the duration of the preceding month would appear to be in the nature of things alternatives, each of which rendered the other unnecessary. It is therefore not a little remarkable that Jewish scrupulosity should have ultimately adopted both expedients.

The doctrine that Adar should only contain twenty-nine days would appear from the names cited in its favour to date from the third century, but in view of (1) the silence of the Palestinian authorities, (2) the opposition which, as the Babylonian Talmud proves, this doctrine had to encounter in the third and fourth centuries, and (3) the appearance at least as early as the second century of a rival solution to the difficulty which this doctrine was devised to meet, it seems to me impossible to hold that this disputed doctrine of the third century A. D. represents a recognized calendar rule of the first century. I continue therefore to accept the statement of the Mishna that a thirtieth day was always assigned to a month when the moon failed to make her appearance at the end of the twenty-ninth day.

If such a rule as Mr Turner contemplates could have existed, it would convert those Saturday dates for Nisan 14, which follow a thirty-day Adar into Friday dates, and those Friday dates which follow a

¹ *Rosh ha-Shana* 19^b-21^a. See *Der Babylonische Talmud* ed. Lazarus Goldschmidt iii (1899) pp. 343-347.

thirty-day Adar into Thursday dates. I insert *ex abundanti cautela* the results of this hypothesis. On 26 Feb. 7 the moon had at sunset a true altitude of 15°·9 and a difference of azimuth of 5°·6, while on 29 Feb. 3 she had a true altitude at sunset of 12°·5 and a difference of azimuth of 8°·6. The moon could easily be visible on both these evenings, and therefore the rule limiting Adar would, if it had existed, have made Nisan begin on the evenings of 26 March 8 and 29 March 4 respectively, always supposing that these dates do not fall too long before the vernal equinox to be possible dates for Nisan. This would give Friday, March 22, for Nisan 14 in 26, and Mr Turner's date, Friday, March 18, in 29. Similarly 27 and 30 would become available for the synoptic date, Nisan 14 falling on Thursday, April 10, in 27 and Thursday, April 6, in 30; but 33 would remain available for the Johannine date only, since the moon could not possibly have been visible on 33 Feb. 18, and Adar must in consequence have lasted till the evening of 33 March 20 as shewn in the table above.

J. K. FOTHERINGHAM.

Τότε IN ST MATTHEW.

IN *Evangelion da-Mepharreshe* ii p. 89 Prof. Burkitt suggests that εἰθὺς in St Mark and οὖν in St John correspond to the Hebrew 'wāw consecutive'. 'Not, of course, that either of these Gospels is a translation from the Hebrew; but if the authors of these Gospels were familiar with the Old Testament otherwise than through the awkward medium of the LXX, they might well have felt themselves in need of something to correspond to the Hebrew idiom. The essence of the meaning of "wāw consecutive" is that the event related is regarded as happening in due sequence to what has gone before.' Prof. J. Weiss, in the May number of the *ZntW.*, disputes the suggestion as regards εἰθὺς, though he admits the possibility in the case of οὖν. But the explanation may almost certainly be extended to the word τότε, which is so characteristic a feature of the first Gospel. The following statistics may be noted. Τότε is used by St Matthew 61 times to carry on a narrative, the verb being aorist 39 times and present 22 times. In the passages in which St Mark or St Luke has a parallel, the corresponding word in St Mark is καί (21 times), δέ (6), εἰθὺς (1), and the copula is omitted thrice; in St Luke it is καί (6), δέ (14), τότε (1), and the copula is omitted twice. Further, Matt. xxv supplies some striking instances in which τότε expresses consecutive action in the future; see vv. 34, 37, 41, 44, 45. The most noteworthy of all occurs in v. 1: τότε ὁμοθυμῆ-